CLAIMS

1. A process for controlling a circulating fluid bed oxygenates to olefins reactor which comprises:
contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;
measuring a set variable selected from at least one of (1) reactant feed rate, (2) feed enthalpy, (3) reactor temperature-related function, and (4) catalyst hold-up in the riser of the reactor, said set variable functionally corresponding to a process variable selected from at least one of i) space velocity, ii) average reaction temperature, iii) conversion of reactant, and iv) average coke level on catalyst;
comparing said measured set variable with an optimal set variable to provide a signal which is a function of the difference between said measured set variable and said optimal set variable;
adjusting as a function of said signal a corresponding manipulated variable selected from at least one of a) at least one feed flow control valve, b) feed preheat rate, c) activity of the catalyst in the reactor, and d) amount of catalyst in the reaction zone, to improve at least one of light olefin production rate and light olefin selectivity.

2. The process of claim 1 wherein said process for controlling a fluid bed oxygenates to olefins reactor comprises:

contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;

measuring reactant feed rate as a set variable functionally corresponding to space velocity as a process variable;

comparing said measured set variable with an optimal set variable to provide a signal which is a function of the difference between said measured set variable and said optimal set variable;

adjusting, as a function of said signal, at least one feed flow control valve as a corresponding manipulated variable, to improve at least one of light olefin production rate and light olefin selectivity.

3. The process of claim 1 wherein said process for controlling a fluid bed oxygenates to olefins reactor comprises:

contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;

measuring feed enthalpy as a set variable functionally corresponding to ii) average reaction temperature as a process variable;

comparing said measured set variable with an optimal set variable to provide a signal which is a function of the difference between said measured set variable and said optimal set variable;

adjusting, as a function of said signal, feed preheat rate as a corresponding manipulated variable, to improve at least one of light olefin production rate and light olefin selectivity.

4. The process of claim 1 wherein said process for controlling a fluid bed oxygenates to olefins reactor comprises:

contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;

measuring said reactor temperature-related function as a set variable functionally corresponding to conversion of reactant as a process variable;

comparing said measured set variable with an optimal set variable to provide a signal which is a function of the difference between said measured set variable and said optimal set variable;

adjusting, as a function of said signal, activity of the catalyst in the reactor as a corresponding manipulated variable, to improve at least one of light olefin production rate and light olefin selectivity.

5. The process of claim 1 wherein said process for controlling a fluid bed oxygenates to olefins reactor comprises:

contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;

measuring said reactor temperature-related function as a set variable functionally corresponding to conversion of reactant as a process variable;

comparing said measured set variable with an optimal set variable to provide a signal which is a function of the difference between said measured set variable and said optimal set variable; and

adjusting, as a function of said signal, the catalyst holdup in the riser to improve at least one of light olefin production rate and light olefin selectivity.

6. The process of claim 1 wherein said process for controlling a fluid bed oxygenates to olefins reactor comprises:

contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;

measuring reactor temperature at a plurality of locations along the reactor as a set variable functionally corresponding to conversion of reactant as a process variable;

comparing said measured set variable with an optimal set variable to provide a signal which is a function of the difference between said measured set variable and said optimal set variable; and

adjusting, as a function of said signal, activity of the catalyst in the reactor as a corresponding manipulated variable, to improve at least one of light olefin production rate and light olefin selectivity.

7. The process of claim 1 wherein said process for controlling a fluid bed oxygenates to olefins reactor comprises:

contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;

measuring said reactor temperature-related function as a set variable functionally corresponding to conversion of reactant as a process variable;

comparing said measured set variable with an optimal set variable to provide a signal which is a function of the difference between said measured set variable and said optimal set variable; and

adjusting, as a function of said signal, the catalyst holdup in the riser to improve at least one of light olefin production rate and light olefin selectivity .

8. The process of claim 1 wherein said process for controlling a fluid bed oxygenates to olefins reactor comprises:

contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;

measuring catalyst hold-up in the riser of the reactor as a set variable functionally corresponding to average coke level on catalyst as a process variable,

comparing said measured set variable with an optimal set variable to provide a signal which is a function of the difference between said measured set variable and said optimal set variable;

adjusting, as a function of said signal, amount of catalyst in the reaction zone as a corresponding manipulated variable, to improve at least one of light olefin production rate and light olefin selectivity.

9. The process of claim 1 for controlling a fluid bed oxygenates to olefins reactor which comprises:

contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;

measuring (1) reactant feed rate, (2) feed enthalpy, (3) reactor temperature-related function, and (4) catalyst hold-up in the riser of the reactor, as set variables functionally corresponding to process variables i) space velocity, ii) average reaction temperature, iii) conversion of reactant, and iv) average coke level on catalyst;

comparing said measured set variables with corresponding optimal set variables to provide signals each of which is a function of the difference between each respective measured set variable and each corresponding optimal set variable;

adjusting as a function of said signals a) at least one feed flow control valve, b) feed preheat rate, c) activity of the catalyst in the reactor and d) amount of catalyst in the reaction zone, as corresponding manipulated variables, to improve at least one of light olefin production rate and light olefin selectivity.

10. The process of claim 1 further comprising the step of contacting an oxygenate feed with a silicoaluminophosphate (SAPO) molecular sieve catalyst under conditions effective to convert said oxygenate feed to

olefins, wherein said conditions comprise a weight hourly space velocity (WHSV) of from about 20 hr^{-1} to about 1000 hr^{-1}.

11. The process of claim 1 wherein said conditions comprise a temperature of at least about 300°C.

12. The process of claim 1 wherein said conditions comprise a temperature in the range of from about 400°C. to about 500°C.

13. The process of claim 1 wherein said silicoaluminophosphate molecular sieve catalyst is selected from the group consisting of SAPO-17, SAPO-18, SAPO-34, and SAPO-44.

14. The process of claim 1 wherein said molecular sieve catalyst is SAPO-34.

15. The process of claim 1 wherein said oxygenate feed is selected from the group consisting of aliphatic alcohols, aliphatic ethers, and aliphatic carbonyl compounds.

16. The process of claim 15 wherein said aliphatic moiety ranges from about 1 to about 10 carbon atoms.

17. The process of claim 15 wherein said oxygenate feed comprises methanol.

18. The process of claim 1 wherein said reactor temperature-related function is a reactor mid-temperature taken at a single location between about 20% to about 80% of the axial length of the reactor.

19. The process of claim 1 wherein said reactor temperature-related function is a rate of temperature rise along a portion of the reactor.

20. A process for controlling an oxygenates to olefins fluidized bed reactor which comprises:

contacting an oxygenate-containing feedstock in a reaction zone in the presence of a molecular sieve oxygenates to olefins conversion catalyst under oxygenate conversion conditions;

determining an optimized value of a primary variable measurable property;

selecting a secondary variable measurable property which is more readily measurable or more reliably measurable than said primary variable measurable property and determining a set point for said secondary variable measurable property corresponding to said optimized value of the primary variable measurable property;

measuring said secondary variable measurable property;

comparing said measured secondary variable measurable property with said set point for said secondary variable measurable property corresponding to said optimized value of the primary variable measurable property to provide a signal which is a function of the difference between said measured secondary variable measurable property and said set point corresponding to said optimized value of the primary variable measurable property; and

adjusting as a function of said signal a corresponding manipulated variable.

21. The process of claim 20 wherein

said primary variable measurable property is selected from the group consisting of 1) desired production rate, 2) temperature-related product selectivities, 3) conversion of reactant, and 4) space velocity;

said secondary variable measurable property is selected from i) total feed rate, ii) feed enthalpy, iii) reactor temperature-related function and iv) catalyst holdup; and

said manipulated variable is selected from at least one of a) at least one feed flow control valve, b) feed preheat rate, c) activity of the catalyst in the reactor (regeneration rate), and d) catalyst circulation slide control valve; and further

wherein 1), i) and a); 2), ii) and b); 3), iii) and c); and 4), iv) and d) represent corresponding sets of variables.

22. The process of claim 21 wherein said reactor temperature-related function is a reactor mid-temperature taken at a single location between about 20% to about 80% of the axial length of the reactor.

23. The process of claim 21 wherein said reactor temperature-related function is a rate of temperature rise along a portion of the reactor.

24. An oxygenates to olefins fluidized bed reactor apparatus for converting an oxygenate feed to olefins in a riser reactor which comprises:

an oxygenate feed line communicating with a riser reactor feed inlet to said riser reactor;

a preheater through which said oxygenate feed line passes for at least partially vaporizing said feed by heat exchange with a fluid heating medium flowing through said preheater;

said riser reactor further comprising a riser reactor outlet for riser reactor effluent containing solid catalyst particles and olefins-containing vapor;

a disengaging vessel for receiving said riser reactor effluent and separating at least some of said solid catalyst particles from said effluent, said disengaging vessel further comprising a disengaging vessel outlet at an upper portion of said vessel for removing said olefins-containing vapor;

a catalyst circulation line running downward from a lower portion of said disengaging vessel to a lower portion of said riser reactor;

a regenerator comprising a lower inlet for introducing a regeneration medium, an upper outlet for regenerator flue gas, said regenerator further comprising a catalyst transport line running downwardly from a lower portion of said disengaging vessel to a regenerator catalyst inlet, and a catalyst transport line extending downwardly from a regenerated catalyst outlet and intersecting with a lift gas riser;

said lift gas riser having an upper outlet communicating with said disengaging vessel and a lower lift gas inlet; and said reactor apparatus further comprising at least one of:

A) a heating medium flow control valve controlling the flow of said fluid heating medium through said preheater, which heating medium flow control valve is manipulated as a function of temperature of said feed measured at a point between said preheater and said riser reactor feed inlet;

B) an oxygenate feed flow control valve controlling the flow of said feed from said preheater to said reactor inlet which is manipulated as a function of feed flow measured at a point between said preheater and said riser reactor inlet;

C) a catalyst circulation control valve controlling circulation of catalyst from said disengaging vessel to said riser reactor, said catalyst circulation valve being manipulated as a function of the difference in pressure between an upper portion of said riser reactor and a lower portion of said riser reactor; and

D) a regenerator catalyst circulation control valve controlling the passage of catalyst from said regenerated catalyst outlet to said lift gas riser, said regenerator catalyst circulation control valve being manipulated as a function of riser reactor temperature.

25. The apparatus of claim 24 wherein said reactor apparatus comprises A).

26. The apparatus of claim 24 wherein said reactor apparatus comprises B).

27. The apparatus of claim 24 wherein said reactor apparatus comprises C).

28. The apparatus of claim 24 wherein said reactor apparatus comprises D).

29. The apparatus of claim 24 wherein said reactor apparatus comprises A), B), C) and D).

30. The apparatus of claim 24 wherein said riser reactor temperature is measured at a point ranging from 30% to 40% of said riser reactor length, measured from said feed inlet of the riser reactor.

31. The apparatus of claim 24 wherein said function of riser reactor temperature is a reactor mid-temperature taken at a single location between about 20% to about 80% of the axial length of the reactor.

32. The apparatus of claim 24 wherein said function of riser reactor temperature is a rate of temperature rise along a portion of the reactor.